

THE VSE OF
THE IACOBS
STAFFE.

Good 17.1 K



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THE USE OF
THE JACOBS
STAFF



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D. 1800

TO THE RIGHT HO-
NORABLE L. IOHN
LVMLEY, BARON
LVMLEY. &c.



After that I had penned (right honourable) the vse of the Crosse staffe, I was desired by mine acquaintance, to take the like paynes in the Iacobs staffe. I did so: my paynes were lyked and called (as the former) vnto the presse. Without a patrone I would not haue it come forth, because I would not be thought to be without a Patrone. To trouble one man with them both, I thought it not good, least I shoulde seeme forgetfull of other my welwillers: among whom your good will, shewed vnto me at dyuers tymes, hath emboldened me to craue your patronage for the thying, which if it shall please your Honour to vndertake, I shall accompt it a speciall token of your louing fauour, and acknowledge my selfe in recompence, bounde to pray for your Honours dayly increase in al kinds of blefsings.

Your Honors most
humble. Tb. Hood.

TO THE RIGHT HO-
 NORABLE L. JOHN
 LAMLEY, BARON
 LAMLEY. &c.



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Your Honours most
 humble. T. Hook.

A:

A Dialogue touching the vse of the Iacobes Staffe.

Scholler.

Since my last departure from you, I haue diligently applyed the crosse Staffe, according vnto the rules which you haue prescribed, and finde the same to be verie convenient for the purpose, which you haue set downe: that is, for the taking of the heyght of the Sunne and Starres, with their distaunces: Yet can I not stay my selfe here, but must once agayne presume vpon your curtesie.

Master. What is it that you desire? I loue not many words, but you shall finde me most readie to pleasure you, or any man els, as far forth as my simple skyll wyll afforde me.

Sc. This is the matter: I woulde gladly learne the vse of the Iacobes Staffe as well as I haue learned the vse of the crosse staffe: May I not therefore so diuide the crosse staffe on the one side, that it may serue my turne for a Iacobes staffe, so that I be not troubled with the carriage of any more then one?

Ma. Yes, very well. And loe, here is one so diuided, that as the one syde of the Varde and Transame seruech for the Sunne and Stars, so the other seruech for any dimension.

Sc. This falleth out euen as I woulde haue it: seeing therefore the Staffe is readie at hande, if your leysure serue, I pray you instruct me in the vse thereof.

Ma. With a good wyll: Doue you the questions, and I wyll answer them.

Sc. Why do they call it Iacobes Staffe? Was he the first inventor of the thing.

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Ma. I know not that: but they take occasion to call it so, by reason of those wordes which are written Gen. 32. 10. where the Patriarch sayth, *That with his Staffe he came ouer Iordane:* Wherein I thinke, they misconfure his meanyng. Notwithstanding, by whom soeuer it was inuented, the Instrument questionlesse is of singuler vse.

Sc. Let that passe, and declare I pray you, what affinitie this Staffe hath with the other. For comparisons wyll make a thyng more playne.

Ma. First, as in the other Staffe, the degrees of the Yarde and Transame are all one in number, so are the partitions in this. Secondly, as the Yarde and Transame in that, do ioyne together squarewysse and at rightangles, so must they do in this. Thirdly, there must the same consideration be had in placing of the Vane in this, that was had in the placing of the Vane in the other: that is, it must stande even with the beginning of the partitions, except some special occasion require otherwysse, as is to be seene in the measuring of breadthes. Fourthly, One of the two, eyther the Yarde or the Transame, as occasion serueth, must be parallele vnto the thyng measured, the other must be perpendicular.

Sc. Is that a rule to be noted in the Jacobs Staffe?

Ma. Yea that it is: otherwysse it is most certayne you commit an error.

Sc. Then haue I been amysse informed, and I haue seene men, that haue thought them selues to be of no small cunning in the vse of the Staffe, who measurynge the height of a thyng, haue made no matter how they helde their Staffe, so that they did see the toppe and the bottome of the thyng to be measured, even with the two endes of their Transame.

Ma. Belecue me in this, that it can not be that their practise shoulde be true. This one argument shall serue for a thousand. You know that the prooffe of the vse of the Jacobs Staffe standeth vpon the proportion of Triangles. Now those Triangles

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gles onely are proportionall which are lyke, and in lyke manner situated, which they can neuer be except eyther the parde, or the Transame be parallel or perpendicular (as occasion serueth) to the thyng measured.

Sc. Your reason is good that it shoulde be so: but me thinketh that the perfourmaunce thereof shoulde be impossible.

Ma. Why so?

Sc. You know that many fieldes be full of Dales and hollow places: others be full of Hilles and Mountaines. Moreover, many thinges stande not vpright vpon the Grounde, but leane eyther forwarde or backward, or els to the one syde or to the other. Last of all in the breadth of a thing there is a great varietie. For bee it in a wall, or fielde, or what else soener, there is for the most part eyther an hollownesse or roundnesse, or some such like thing which may make that impossible in my iudgement to drawe either parallele or perpendicular line vnto them.

Ma. I graunt those thinges to bee as you say: yet doo they not hinder a man from taking the measure of their length, heigth, or breadth. For where the place it selfe dooth not afforde a leuelnesse: it is an easie matter to imagine it leuell. Thus also you must thinke with your selfe, that although Geometrie bee the Arte of measuring well, and generally nothing may bee excluded from the compasse thereof, yet must wee not bee too curious in particulars, least we shewe our selues either ouer wise, or else too foolish. The Physittian generally professeth to heale all diseases, but when he commeth to deale with particular bodies, he faileth in his art, and yet is not to be discommended so long as hee dooth that which arte requireth. It is inough for the Geometrician, if hee giue the iust length of a streight line drawne betwene two places assigned. Or if hee can not doo it by one straight line, hee may doo it by manie. Whosoever immediately (for mediately he may find out the length of a crooked line by meanes of a straight line)

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whosoever, I say, requireth any more of him then that, hee abusech both the man and the arte. Therefore, when any thing is propounded to be measured, be it length, height, or breadth, you are first of all to consider, whether the thing lie leuell, or stand vpright, or be straight, as it is required that it should be. If it bee straight, you may presently fall in hande to measure it, as your rule shall direct you: If it be not straight, but bee either crooked, or leaning one way or another, it must be your principall care, first to fitte the same to your purpose: as for example, in measuring the distaunce of a thing (for I will first beginne with that dimension, and will afterwards teach you what you shall do in the rest) if the distaunce betweene two places assigned be not straight, as you see in these figures which followe it is not, then chuse out two pointes in the distance, the one being at the one ende thereof, and the other in the other, betweene which you may imagine a right line to be drawne, and then so holde your Staffe, that the Ward or the Transame may be parallele, or perpendicular vnto it, as occasion shall serue.

Sc. You haue thoroughly satisfied me in this. Tell me now wherein these stauies do differ, seeing you haue declared where in they do agree.

Ma. Their difference consisteth in two things specially: in their partitions, and in their vse.

Sc. Touching the first difference, it is euident indeed, that the partes of the other Staffe are vnequall, and that this is diuided into equall portions: but maketh it any matter howe many the partes are into which this Staffe is diuided?

Ma. No: The more the better, and more precise will your worke be. And therefore, if you could diuide them into 100000, it were the more commendable, but 1000 sufficeth in this Staffe, which though it be not diuided into more, yet you may imagine it to be an hundred times as much as it is.

Sc. What is the difference in the vse of the Stauies?

Ma. The generall difference is this: the other serueth

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for Astronomicall matters: this serueth for measuring of lande.

Sc. What meane you by those wordes, Measuring of lande? Is it to take the breadth, or length onely of a field? or may it be applied other wise?

Ma. The trueth is this, that by this Staffe we may measure the length, the height, and the breadth of any thing, all the which we expresse by those wordes, Measuring of lande: hauing relation to the worde Geometric, which signifieth the same, if it be construed word for word.

Sc. Before I doe come vnto the particular measuring of these three dimensions, length, height, and breadth, what generall notes haue I to obserue?

Ma. First, that whether the Yarde or the Transame bee applyed vnto your sight, it must stande close vnto the ball of your cheeke.

Sc. But which ende of the Yarde or Transame must stande to the sight ward?

Ma. That which hath the beginning of the degrees: for so it is most conuenient for the readynesse of your account. The second note is this: to winke with one eye. For the sight by that meanes will ayne at your marke the better, when it is not parted but brought into one. The third obseruation is this: that the distance of your marke be not ouer great.

Sc. Why do you giue this note, considering that in the vse of the other Staffe, there was no limitation made of any distance? For you measure therewith the starres in heauen.

Ma. The case is not all one, because the Starres haue a brightnesse which helpeth their sight, and their beame cometh directly from the Centre of their bodie, vnto our eye. But in terrestriall things it is not so: For in them, by reason of the weaknesse of our sight, we may bee greatly deceiued, except they be within a reasonable compass.

Sc. What do you call a reasonable compass, or distance?

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M. It cannot well bee defined, because there are so many things required therein, that they will hardly iunpe altogether generally: as these, the clearenesse of the ayre: the goodnesse of the sight: the largenesse of the instrument. The ayre may bee cleare, but the sight of a man may bee dull. Againe, the sight may bee quicke ynough, but the ayre may bee thicke. Againe, both the ayre and sight may serue the turne, but the instrument which hee is to vse may bee so small, that hee can not take any thing farre distant from him. So that wee can not generally determine of the distaunce otherwise then thus, saying that that is a reasonable distaunce, which is proportionable both to our instrument and light.

Sc. Proceede. I pray you in the matter whercof you were.

M. The fourth regard must be had vnto your hands that they be steddie. For otherwise you may misse of the proportion of your measure. The last note is this, to take heede vnto the place wherein you make your station.

Sc. How shall I be sure of that?

M. Thus: You knowe this, that either you stande upright, or ye leane one way or other. To be short, howsoeuer your situation be, whether it be standing, sitting, leaning, or vpright, that is the place of your station, which is right beneath your eye, so directly as is possible to bee iudged and taken.

Sc. These five things you say are generally to be noted. 1. The setting of the Staffe at the ball of the eye: 2. The winckling with one eye: 3. a reasonable distaunce: 4. a steddie hande: 5. the certaine place of our standing. Let vs now come vnto the particular vse of the Staffe in the three dimensions. You say, the Iacobs Staffe serueth to take the length, the height, and the breadth of any thing: Are these dimensions founde out any more wayes then one?

M. Yea:

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M^a. **Q^{ue}stion.** The length, and the height, are found out three severall wayes, and the breadth two wayes. The first and the second way require one station: the last way in each dimension is performed by two stations.

Aⁿsw^{er}. What meane you by a station? and what is it to performe a thing by one or mo stations?

Aⁿsw^{er}. A station is nothing else but the place wherein you stand: to performe a thing therefore at one station, is nothing else but by standing in one onelie place by the helpe of your instrument, to take the measure of a thing. To performe it at two stations, is by standing in two severall places to take your measure.

Q^{ue}stion. What generall note is there to be observed, when wee measure a thing at one station?

Aⁿsw^{er}. What knowe this, that the measuring of a thing by the Iacobs Staffe, dependeth wholly upon proportions, whose first and last ends is this, by three numbers given, to finde out the fourth. Two of these numbers are alwayes the partes of your Staffe, the one being the partes of the Transame, the other of the Yarde: the which numbers must be placed according to the rules which followe shall direct you. The third number of proportion is some assigned measure in this manner. If you measure the length of a thing, some certaine height must be assigned. If you measure the height or breadth of a thing, some certaine length, or distance must be given you for your third proportionall number, and this number must keepe the third place in the rule of Proportion, or Golden rule, or rule of three, as wee do commonly terme it. Then must wee say thus: that, as the partes of the Transame cutte off by the Yarde, are vnto the partes of the Yarde cutte off by the Transame: Or contrariwise. As the partes of the Yarde cutte off by the Transame, are vnto the partes of the Transame cut off by the Yarde, so is the assigned measure which is given you, vnto the measure of the

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the thing sought for. This is the chiefest note in measuring at one station.

Sc. What note is there to be obserued in measuring at two stations?

Ma. There are three things specially to be noted: The first is, the making of your stations, that they be both of them in a right line with the thing to the which you leuell your staffe, whether you go forward or backward.

Sc. How may that be done?

Ma. Chuse out some marke in the thing to be measured, which may be leuell with your eye, then set by two staves where you minde to make your two stations, so that standing at the further staffe, you may bring the neker iust with the marke which you too chuse out: so shall you be sure that the two stations are in a right line with the marke chosen. For it is a generall rule, that if three poyns be in one leuell of the eye, those three points are in one right line. The second is, that your eye be no higher at the one station then it is at the other. This is to be done by the rule which I gaue you euen now. For if you, standing at your second station, and holding your staffe leuell from your sight, can see the toppe of the staffe which standeth at your first station, and also the marke which you chuse, it is a certaine signe that your eye is in his iust height. The third note is, that the distance betweene the two stations be diligently taken, and that in a right line, so neere as is possible: because the whole arte of measuring by the Jacobs staffe, dependeth vpon right lines. This distance must be the third number of your proportion. And these be the chiefest obseruations that I remember. If there be any thing else, I will put you in mind thereof as occasion serueth.

Sc. Let vs come now vnto the particular dimensions, and begin first with the length: What call you the length of the thing measured?

Ma. It is the distance betweene the place wheron you stand, and the place assigned, vnto which you direct your sight: and

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in this case we do commonly say thus, How farre is it from my foote, to such, or such a thyng: as a Tree or House, &c.

Sch. Geue me now the rules whereby I may direct my selfe in measuring any distaunce geuen.

Ma. The first rule requireth, that the Yarde shoulde be perpendiculer to the length measured: And that is thus. The Yarde of your Staffe being perpendiculer vnto the thyng measured. If your sight passe from the toppe of the Yarde ouer the ende of the Transame to the farther ende of the thing propounded, as the partes of the Yarde cut off by the Transame, shalbe vnto the partes of the Transame cut off by the Yarde, so shall the heygth of him that measureth be vnto the length of the thing propounded.

Sch. Here are two questions to be propounded. First, what call you the ende of the Transame?

Ma. That is generally called the ende of the Transame, ouer y which your eye sight passeth wheresoener it be, whether it be in the very ende of the woodde it selfe, or any other place, where you list to set the Vane, so that your eye sight passe by that place.

Sc. Secondly, what cal you the heygth of him that measureth? For some man may be, and is a great deale hygher then another.

Ma. The heigth of the measure is the distaunce betweene the toppe of the Staffe and the thyng measured: as in the 1. Figure, from y. to o, and from a. to o. is the heygth of the measurer: so that whether he stande vpon the Grounde at the one ende of the distaunce allined, or whether he stande vpon some higher place, the maner of worke is all one: this beyng noted as a generall rule: That the heigth of the toppe of the Yarde from the grounde, must be certaynely known.

Sc. Expresse the meanyng of your Rule by some example.

Ma. Put case the partes of the Yarde cut off by the Transame

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same be 60, and the partes of the Transame cut off by the Warde be 180, let the height of the Staffe from the ground be 4. foote: then I say that as 60, which are the partes of the Warde, are vnto 180, which are the partes of the Transame: euen so is 4. feete, which is the supposed height of him that measureth vnto the length propounded. So that I conclude the length thereof to be 12. foote.

Sc. This is easily concluded, and dependeth, as I remember vpon the 4. p. of the 6. booke of Euclide: where it is sayd that: In equiangle triangles, the sides which conteyne the equal Angles are proportionall, and the sides which are subtended vnder the equall Angles, are of lyke proportion. Moreover I perceyue (as you tolde me before) that the thyrde number of the proportion, is the assigned height.

Ma. It is true: and you may most manifestly perceyue that in the Figure which you sayd concerning Euclides proposition: For the 2. Triangles a. e. i. and a. o. u. are lyke, because they are situated after one and the selfe same maner: therefore in the Triangle a. e. i. as a. e. is vnto a. i. so in the Triangle a. o. u. a. o. is vnto o. u. Thus you see the commoditie of the Staffe in measuring the length of a thyng. And here you must note this, That it is no matter whether the thyng measured do lie in a plaine or flatte, or whether it be in the ascension, or descension of an Hill; or whether there be any concauitie or conuexitie betweene the endes of the thyng measured. So that by this Rule, we may measure the breadth of any Riuer, or of any Trench, or of any Valley betweene the toppes of Hilles, or the distaunce of two Shyppes at Sea. &c.

Sc. The fyrst Rule required, that the Warde should be perpendicular vnto the thyng measured. But case the Warde do lie parallele vnto it, as it is in the 2. Figure, what then?

Ma. The Yarde being parallele vnto the thyng measured, if your sight passe from the beginning of the Yarde ouer the

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the ende of the Transame, then, as the partes of the Transame cut off by the Yarde, are vnto the partes of the Yarde cut off by the Transame, so is the heygth assigned vnto the length propounded to be measured.

Sc. So then by your Rule I conclude, that yf the partes of the Transame cut off by the Yarde be. 120. partes: and the partes of the Yarde cut off by the Transame be. 210. and the height assigned and knowne be. 400. feete, the length to be measured must be. 700. feete, as I perceiue by the Golden rule, and by the proposition of Euclide mentioned before.

Ma. You say very true: for considering the two Triangles a. u. o. and a. l. e. are lyke, it must needs folow, that as in the lesser Triangle o. u. is vnto u. a: so in the greater e. i. must be vnto i. a.

Sc. You sayde heretofore, that there were 3. wayes to finde out the length of any thyng, whercof 2. are already set downe: What is the thirde way?

Ma. The two wayes already set downe, require but one station. For you are not bounde to remoue from the place whereon you first set your foote when you beginne to measure. But this thyrde way requirerh a double station, as in the 3. figure, which is many tymes necessarie, because that a Tree, or a Wall, or an Hill, may be betwene our sight and the ende of the thyng whose distaunce from vs we desire to knowe, so that our sight cannot come vnto the ende thereof. The thyrde way differeth from the former in this, that there is no altitude to be assigned and geuen for the thyrde number of the proportion, but the thyrde number of the proportion is the distaunce betwene the two stations.

Sc. I pray you answere me in this: Considering that I must take 2. stations, at which is it best to begin? Is it best to beginne my first station at the ende of the distaunce propounded, and so go backwarde? or is it best to beginne my first station a good way from the ende of the distaunce propounded, and then come forwarde to make my seconde station?

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Q. That is neither here nor there. But the common use is to begin the first station, at the ende of the distance propounded, and so go backward: in the which thing doing, you must take heed of that especially, which I tolde you before, that you go backward in a straight line: so that the line imagined to be drawne from the one ende of the distance propounded, unto the other, being continued unto the second station, must make but one right line: otherwise you shall erre in your measure more or lesse.

S. What distance is best to be made betwene the two stations?

M. The larger the better: For it is good never to take a short station, if you may have a large one: because your errout will be the lesse thereby.

S. Give me now the rule which I must follow.

M. The Yard being parallel vnto the length propounded to be measured, and your eye at eche severall station, passing from the head thereof over the end of the Transame, vnto something that standeth vpright, at the farther end of the distance propounded: as the difference of the greater segment of your Transame shall be vnto the lesser segment: so shall the length betwene the two stations be vnto the distance propounded.

S. In this kinde of measuring, must the Transame keepe one place upon the Yard, without pulling it nigher, or putting it farther off from the sight?

M. The rule that I gave you even now requireth that it should do so. And then you must note this, that the farther you go backward from your first station, the lower must the Transame sinke into his socket.

S. Give me an example of that which you have said.

M. Put case that at your first station the partes of the Transame cut off by the Yarde were 108. at your seconde station, put case the partes of the Transame cut off by the Yarde were 72, imagine also the distance betwene your two stations were

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were 40. fete: I must stroke out the difference betwene the seuerall partes of the transame cut off by the Part: which by subtraction I finde to be 36. (for that is the remainder, 72. being subducted out of 108) whereupon I conclude thus, that as the difference of the greater segment of the Transame, namely, 36. is vnto the lesser segment, which is 72. so is the distance betwene my two stations, to y^e length propounded: and therefore the length propounded to be measured is 80. fete. For if 36. giue 72. then 40. fete (which is the distance of the two stations) must needes yeeld 80. Thus haue you hitherto seene the thre seuerall wayes howe to measure the length of any thing propounded. It followeth now to instruct you in taking the heigth of any thing propounded.

Se. What call you the heigth of a thing?

Ma. The heigth of a thing, is the perpendicular drawn from the toppe thereof, vnto the base whereon it standeth.

Se. Then you regarde not at all the crookednesse of a thing.

Ma. No: I care not at all for the fashion thereof. For whether it leane forward or backward, to the right hand, or to the left, I care not, so that from the toppe thereof I may drawe downe a perpendicular line: as you see in the fourth figure.

Se. Do you take all this line?

Ma. Your measure taketh no more then is from the leuell of your eye upward: and therefore this must be a geneall rule, that, if the thing propounded to be measured, do stand leuell with your fete, you must adde vnto the height found out, the height also of your owne stature.

Se. How many wayes is the height of a thing measured?

Ma. Three manner of wayes, euen as the length or distance was.

Se. What must bee the third proportionall number in the first two wayes?

Ma. As in the measuring of lengths, the height assigned

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and giuen, was the third proportionall number: so in the measuring of heigths the length assigned is the thirde number of the proportion.

Sc. Giue me the rules to direct me by,

Ma. The first rule is this: Your Transame making a right angle with the heighth to be measured, and your sight passing from the beginning thereof to the toppe of the heighth: as the partes of the Transame cut off by the yarde, are to the partes of the yarde cut off by the Transame, so is the length giuen, vnto the heighth.

Sc. Put case then the partes of the Transame were 60, and the partes of the Yarde 36, and the length giuen 20. feete: the height according to the rule must be 12. feete.

Ma. It is so: But you must remember to adde the height of your owne stature: so that it shall be in all 16. feete, or 15. feete according as you shall please to allow for your owne height.

Sc. Let me request this by the way: is there no rule for the measuring of deapths?

Ma. It is all one with the measuring of heigths. For the deapth is nothing else but a reuerfed heighth. And therefore in the measuring of the deapth of a thing, The Yarde of your Staffe beeing parallele vnto the side of the thing whose depth you measure, and your sight passing from the toppe thereof: as the partes of the Transame cutte off by the Yarde, are to the partes of the Yarde cutte off by the Transame, so is the assigned length vnto the depth of the thing.

Sc. I perceyue your meaning. As for example: If the parts of the Transame be 5, and the parts of the Yarde 13, and the diameter of the well (which is here in this example the assigned length) be 10. feete long, the depth must be 26. feete.

Ma. It is true, if you account from the toppe of your Staffe, & therefore that you may haue the full depth of the thing, you must take away from the aforesayd number as much as is aboue the thing measured: which if you suppose to bee one

foote

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foote in length then is the well 25. foote deepe, as appeareth in the fifth figure.

Sc. Thus much by the way concerning the measuring of any depth. What other rule haue you for the measuring of heighths?

Ma. The first rule required that the Transame should be perpendicular vnto the heighth propounded. The second requireth the Yarde to be perpendicular: as in the sixt figure: so that it differeth from the other onely in the maner of holding the Staffe. The rule is this: The Yarde of your Staffe being perpendicular vnto the thing measured as the partes of the Yarde are to the parts of the Transame, so is the assigned length vnto the height propounded to be measured.

Sc. So that I may conclude thus. If the partes of the Yarde be 60. and the partes of the Transame 60. and the assigned length be 250. feete: the height propounded must also be 250. feete.

Ma. Your conclusion is allowable: But I must put you in minde of this, to adde the allowaunce of your stature, which if you suppose to be 4. feete, then is the whole heighth 254. feete: Nowe marke this one thing for your further learning.

Sc. What is that?

Ma. By this meane you may finde out the seuerall partes of anie height propounded: as in the seuenth figure you may finde out howe manie feete are conteyned betweene the toppe and the nether side of the windowe: or generally betweene anie partes else, by placing as manie Planes vpon the Transame, as you woulde measure seuerall partes.

Sc. I must so place my Planes, that from the ende of the Yarde I may see each part propounded.

Ma. You say right, the rule then must be this: The Yarde being perpendicular, as it was before vnto the height propounded, as the parts of the yarde cut off by the Transame are
vnto

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vnto the distance of the Vanes, so is the whole height, vnto the part thereof propounded.

Sc. Let me shewe that I vnderstand you, by propounding an example: I say, that if the partes of the Transame bee 50. and the distaunce of the Vanes bee 20. partes: and the whole height of the thing measured be 37. feet, then the part propounded must be 14. fecte, and $\frac{1}{2}$.

Ma. You vnderstand it well. And here is yet another thing to be noted: that if you know the length of any one peece of the thing whose height you desire to knowe, it is sufficient to bring you to the knowledge of the whole heighth, as in the eighth figure.

Sc. What rule haue you for that to direct mee in the worke?

Ma. The Vanes of your Staffe must bee placed as they were before, namely, in such sort that your sight passing from the ende of the Parue by the Vanes, you may see both the ends of the part whose length you knowe. The rule then is this: that as the distance of the two Vanes is vnto the remnant of the Transame downe vnto the Yard, so is the part knowne vnto the remnant of the heighth propounded. So that if the distance of the Vanes be 20. partes, and the remnant of the Transame from the nethermost Vane downwarde be 30. partes: and the part of the heighth knowne be 14. fecte, and $\frac{1}{2}$. I conclude the remnant of the heighth to be 22. fecte, and $\frac{1}{2}$.

Sc. That standeth with reason, and may be proued by the example next going before this. For if the whole height were 37. fecte, and the part propounded 14. fecte, and $\frac{1}{2}$. that part being taken out of the whole, declareth the remnant to be 22. fecte, and $\frac{1}{2}$.

Ma. The former two rules measured the height of a thing at one station. The third rule requireth a double station, as in the ninth figure. The rule is this: The Yard of your Staffe being perpendicular to the thing measured, as the difference of the two segments of the Yard is to the distance betweene the

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the two stations, so are the partes of the Transame cut off by the Yarde to the heigth propounded.

Sc. What meane you by the difference of the two segmentes of the Yarde?

Ma. You may easilie knowe what that meaneth, by that which hath been taught you before, in measuring the distaunce or length of a thyng at two stations. Per I wpll make it plaine vnto you here. When you make your first station, you know the Transame must cut the Yarde in one place or other: also when you make your seconde station, the Transame must cut the Yarde in another place, not the same which was before: the distaunce or partes of the Yarde, conceyned betweene those two seuerall places, are called the difference of the segmentes.

Sc. In this case I must not moue my Transame vp and downe.

Ma. No, but you must moue it only either towarde or from your sight.

Sc. When must it come towarde my sight: and when must it go farther from it?

Ma. That falleth out accordyng to your seuerall stations. If you in making your seconde station, you go farther from the thyng measured, your Transame must goe farther from your sight: If you come nygher, your Transame also must come nigher your syght. And here I giue you warnyng a gayne, that you goe forwarde and backward in a right line, directly vpon the thyng propounded.

Sc. Let me here also by example shewe that I vnderstande your Rule. You say that as the difference betweene the two segmentes of the Yarde is vnto the distaunce betweene the two stations, so are the partes of the Transame vnto the heigth. Whereupon I conclude thus: that if the difference of the two segmentes be 23. and the distaunce of the two stations be 30. feete, and the partes of the Transame cut off by the Yarde be 44. then the heigth must be 57. feete and $\frac{23}{3}$, as in the Figure.

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Ma.

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No. *Ma.* Hitherto you haue learned how to measure the length and the heigth of things: nowe it followeth to measure the breadth.

Sc. Giue me leaue, I pray you, in this place to moue three questions: and first what meane you by the breadth?

Ma. The breadth here to be measured, is no more, then the length of the right line, conteyned betweene the two endes of the thing propounded, without any consideration of the roundnesse or holownesse of the thing.

Sc. Secondly, how must I stand to hold my Staffe?

Ma. You must stand so, that your staffe being applied vnto your eye, it may be perpendicular vnto the breadth propounded.

Sc. Last of all, when I purpose to measure the breadth of any thing, as of a wall, or such like, agaynst which part of it must I stande? agaynst the iust midst of it? or agaynst the one ende? or else where I please, betweene the two endes? or without both the endes?

Ma. It is at your owne choise.

Sc. In measuring the former dimensions, my sight did passe but by one ende of the Transame, must it do so likewise in this?

Ma. That is according as you stande to take the measure. If you stande within the two endes of the thing propounded to be measured, your sight must passe by the two endes of the Transame. If you stande agaynst the one ende of the thing, or cleane without it, your sight passeth but by one ende of the Transame.

Sc. What meane you here by the ends of the Transame? are they not here also to be taken as they were before?

Ma. Yes: The one ende of your Transame must alwayes be that, where the partitions begin: the other end is that, by which the Transame must stande, and by which the sight passeth. For many times it will so fall out that your sight cannot passe by both the endes of the wood, so that you shall be inforced to place the Transame in some one part or other of the Transame, that

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It may be a limit for your sight. And this is a generall rule that if you stand within the endes of the breadth propounded the one ende of your Transame must be on the one side of the yard, and the other on the other side.

Sc. But will the Yarde be iust betweene them both?

Ma. No: Except your station bee made accordingly. If you stand in the midst of the thing to be measured, then will the Yarde be iust in the midst, betweene the endes of the Transame: if you stande more to the one ende then to the other, the Yarde also will fall out in like maner, more toward the one end of the Transame, then toward the other.

Sc. How many wayes are there to bee vsed to measure the breadth by?

Ma. We may measure it two wayes: either by the helpe of one station, or of two.

Sc. If I measure it by the helpe of one station, what must be knowne for the third proportionall number?

Ma. The distance betweene you and the thing propounded.

Sc. Put case that it be hollowe inward betweene the two endes thereof: or swell outwardly: to which part must I then measure?

Ma. If it be conuexe, or round outwardly, the best way to measure the breadth is by two stations: but if it bee hollowe inward, you must measure no further then from your feete to the right line, which runneth betweene the two endes of the thing propounded.

Sc. What rule is there for the measuring of a breadth at one station?

Ma. This. The Yarde being perpendicular vnto the breadth assigned, as the partes of the Yarde cut off by the Transame, are vnto the partes of the Transame conteyned betwene the two endes, so is the distance betweene your feete and the thing measured, to the breadth thereof. As in the tenth figure.

Sc. I perceiue it well: For there are here two propor-

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tionall triangles cut in peeces with a line in the midst: Therefore as in the triangle A B C. the line B D. is to the line A C. so is the line B E. in the greater triangle to the line F G. which is the breadth of the wall. This dependeth vpon that which went before. Now what is your rule for the measuring at two stations?

M^a. It is this: The Yard being perpendicular vnto the thing measured, and your sight passing by the endes of the Transame (as it is required:) as the difference of the two segments of the yarde is vnto the distaunce betweene the two stations so are the partes of the Transame betweene the two endes thereof, vnto the breadth propounded: as it is in the 11. figure.

Sc. This also is verie easie by reason of that which was taught before. So that I may conclude, that if the difference of the two segments in the Yarde be 30. partes: and the distance of my two stations be 40. fecte: and the parts betweene the two endes of the Transame be 50. then must the breadth of the thing be 66. fecte and $\frac{2}{3}$. Have you any other thing to be added?

M^a. No: But that I would haue you to practise this diligently, and I will hereafter further you in other things.

Sc. I thanke you for it. Yet before I depart, I pray you let me aske you one question: You said before, that in measuring the breadth of any thing it is at my choise to stande where I will, either within the two endes of the thing to be measured, or against the one end thereof, or without both the endes, in what place I shall thinke most expedient. This last kind of measuring me thinketh is strange (as for the other I perceiue well inough howe their proportion will fall out) wherefore I pray you helpe me herein.

M^a. Set the question as you shall thinke it best for your owne vnderstanding.

Sc. But case I were to take the breadth of a riuer, as in the 12. figure, into whose binke I cannot come any nigher then 40. fecte

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40. feete, by reason of some marshy grounds adjoining thereunto: what meanes shall I use to find the breadth thereof?

M^a. You must go thus to worke: (and as you do in this, so must you do in al other things, without whose endes you bee enforced to stand when you take their breadth) chuse out vpon the riuers side two markes, as two trees or such like things, standing one right against another.

Sc. But how must they stand in respect of the riuers?

M^a. In deed that is a speciall thing to be noted: They must stand so, that the right line imagined to come from the two markes, may make a right angle with the riuers side: otherwise you shal erre in taking of your measure: Because that onely is accounted the breadth of a thing, which maketh a right angle with the length.

Sc. Having chosen out these two markes, what is then to be done?

M^a. You must set vp another, which must stand also iust in one right line with the two first markes, whose distance from the marke on this side the riuers, must either be giuen you, as being already certainly knowne: or else it must be found out by the first rule concerning the measuring of breadths.

Sc. But case I either know it, or find it to be 40. feete.

M^a. You must chuse out a conuenient place, wherein you may make your station, and settle your self about your worke.

Sc. How must that place lie from the marke that was last set vp?

M^a. It must lie from it so, that the line drawne from that marke vnto the place of your standing, may make a right angle with the line drawne betweene the three aforesaid markes.

Sc. Must I not knowe the iust length betweene the place wherein I make my station, and the marke which I set vp.

M^a. Yes: For it is the third proportionall number.

Sc. Imagine that distance to be 60. feete.

M^a. Then your rule to finde out the breadth is this: The yard

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Yard being perpendicular with the marke set vp, and your sight passing from the head thereof by the end of the Transame vnto the marke standing on the farthest side of the river, as the parts of the yard cut off by the Transame, are vnto the partes of the Transame cut off by the Yard, so is the distance betweene your station and the marke set vp vnto the distance betweene the said marke, and the marke standing vpon the further side of the river.

Sc. But what is this to the question that I propounded? You make an answer concerning the distance of the two markes, whereas I moued a question of the breadth of the River.

M. Bee not angry, I will satisfie you straight wayes: first find out the distance of these two markes.

Sc. That can I easily do: For the partes of the Yard being 30. and the partes of the Transame 36. and the distance of my station from the first marke 60. fecte. The first marke must be distant from the third 72. fecte.

M. Then what is the breadth of the river.

Sc. That must come from you, for I cannot make the conclusion.

M. Then marke this. You saide the distance of the first marke from the thirde being on the farther side of the River is 72. fecte: and the distance of the first marke from the second being on the hither side of the River, was graunted to be 40. fecte: then take 40. out of 72. and the remainder beeing 32. fecte, declareth the breadth of the River.

Sc. I perceiue now what a commoditie it is to haue an instructor. For the thing which seemed vnto me most strange, and altogether impertinent to my question, is by your meanes made most euident vnto me, and greatly to the matter propounded. But must I take this course, whensoever I am diuinen to stand without the compasse of the thing measured.

M. Yea, that you must: And sometimes also you shall be diuinen to the second rule, wherein two stations are required, which

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which soeuer you vse it commeth all vnto one purpose, and
will easily affoord you the breadth of a thing.

Sc. I can but thanke you for your paynes, and good will,
in accepting me for your scholer.

Ma. And I likewise you, for making choyse of mee to
be your maister. My will is good to helpe whome I may:
howsoeuer others may make more boast of their cunning.

FINIS.

The Jacobs Staffe.

For as much as you are the comendable all unto our purpose, and
will easily afford you the breadth of a thing.
I can but thank you for your paynes, and good will,
in accepting me for your scholar.
And thus I likewise you, for making choice of mee to
be your minister. For will is good to helpe I might say
for as much as others may make more heart of it continuing.

5 JAN 59

**A Dialogue touching the vse of
the Crosse staffe.**



Scholer.

Being vnderstoode that youe haue a kind
of Crosse staffe, somewhat differing from
those of the common sort, I am somewhat
bolde to request a little conference with
you about the same.



Maister. Not so bolde as welcome :

It is my desire to further all men what
I can. I pray you therefore briefly to pro-
pounde what you woulde haue, and I will retorne an an-
swere to your contentation, so farre forth as I may.

Sch. First, I desire to knowe, what ende you haue gene-
rally in the thing?

Ma. The Staffe may be vsed to diuerse purposes: but my
chiefest ende and intencion therein, is to take the height of the
Sunne aboue the Horizon.

Sc. May not a man doo it as well by the other Staffe,
commonly which is called Balla Stella?

Ma. Comparisons are odious: therefore I omit that mat-
ter, and request you to propounde some other question. Yet
this I say, that this Staffe is not so troublesome as that, which
you haue named. Whereouer, the degrees thereof are greater
then those of the other Staffe, though the Staues themselves
be of equall length. For 5. of them are as bigge as 15. in the
Balla Stella. Neither are you tied vnto an Horizon: for it
may be vsed both by lande and sea: and without applying it
vnto your sight.

Sc. There be no small commodities. If therefore I may

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obscure

The vse of

obtaine at your handes the vse of this Staffe, I shall thinke my selfe not a little beholding vnto you.

Ma. Your request is graunted: Take therefore what order you thinke best for your instruction.

Sc. Because I would haue all things plainly deliuered, I will keepe this order in my questions. First, I will begin with the two peeces of wood: and then, with the sockettes: thirdly, I will request the vse of the Vane: and last of all, how the Sunnes altitude may be found out.

Ma. Do so: and I will labour to fulfill your mind.

Sc. First therefore, what names doo you giue vnto these two peeces of wood?

Ma. I call the one the Yard, the other the Transame.

Sc. What meane these markes that are in them?

Ma. They are the degrees of altitude, with their minutes.

Sc. But howe shall I distinguish the Transame from the Yard, seeing the degrees in them both be all of one quantitie, neither hath the one of them anie more degrees then the other?

Ma. It is true that there be 45. degrees in each of them. The Transame conteyneth the first, namely, all the degrees from 1. to 45: the Yard conteyneth the rest, namely, the degrees from 45. vnto 90.

Sc. Is that of necessitie that they should do so?

Ma. No: But by this meane I make the degrees so great as they are.

Sc. Then I perceiue this: that from the rising of the Sunne, vntill he bee rayled 45. degrees aboue the Horizon, his eleuation must be taken in the Transame. Again, after that he is 45. degrees aboue the Horizon, his eleuation must be taken in the Yard.

Ma. It is so.

Sc. May I easily knowe by this staffe, when the Sunne is vnder 45. degrees, and when he is aboue 45. degrees of eleuation?

Ma. Most

the Grosse Staffe.

M. Most easily, and readily: as you shall bee taught hereafter.

Sc. Why is the Yard cut off so close vnto the 90. degree?

M. That it may the better come vnto your sight: wherein the Centre of the circle is imagined from whence all the lines do come.

Sc. Thus much concerning the Transame, and the Yard, Now for the Sockets: to what purpose serue they?

M. They be made to ioyne the Transame and the Yard together.

Sc. What principall note is to be obserued in them?

M. They must be ioyned together squire wise, at right angles.

Sc. To what end are the notches in them?

M. The notches serue to this purpose, to see howe to set the Transame, and the Yard iust vpon his place. For the masse carying a certaine thicknesse with it, doth hinder my sight so, that I cannot well iudge of the true place whereon they should stand, were it not for these notches, which must be no deeper, then the thicknesse of the masse, or if they be deeper, they must be both of one depth.

Sc. To what end serue the Scrues?

M. They serue to none other purpose but this, namely, to keepe the Sockets fast in their places, that they slip not.

Sc. May I put the Sockets vpon the Yard which way so euer I will, without any difference?

M. No: But you must take heede of this, that the Socket wherein the Transame must bee put, must alwayes hang downeward, for so it is best: otherwise there is not any great heede to be taken. And yet for auoyding of confusion, let this be your rule, that The ende whereat your two Sockets close together, be next vnto your sight.

Sc. To what end serueth the Plane?

M. It serueth to take the eleuation of the Sunne, and also to saue your sight from the beames thereof.

The vse of

Sc. In what maner I pray you?

Ma. Of that I wyll informe you hereafter: for the maner being diuers, can not wel be set downe here, without confusion.

Sc. Whereupon must the Vane stande?

Ma. Sometymes vpon the Transame, and sometymes vpon the Yarde, accordyng as the manifolde vse of the Staffe requireth.

Sc. Is it any matter to which hande it standeth: cyther to the right hande, or to the left?

Ma. Yea, that it is: and this Rule shal alwayes serue your turne, V When the Transame standeth on the right hand of the Yarde, let the Vane bende toward the left hande: and contrariwise, when the Transame standeth on the left hand of the Yarde, let the Vane bende toward the right hande.

Sc. Now let me knowe howe I shall ioyne the Transame and the Yarde togeather: for to that ende were the braxen sockettes made.

Ma. They are to be ioyned togeather diuersly, accordyng as the Staffe is diuersly vled.

Sc. Is the Staffe then to be vled after more wayes then one?

Ma. Yea, for you may choose whether you wyll apply it vnto your eye (as you do the Balla stella) or whether you wyll holde it in your hande, and finde the height of the Sunne by the shadowe of the Vane.

Sc. Is there any generall obseruation to be noted in these severall vles.

Ma. Yea: For this is a generall rule, that whether you apply it vnto your eye, or whether you holde it in your hand, the Transame must be alwayes perpendicular vnto the Horizon, and the Yarde leuell vnto the same.

Sc. But how shal I be assured of the perpendicularitie, and the parallelitie of the one and the other?

Ma. At the Sea, where your Horizon is free, if you bring the Yarde euen with the closing of the Heauen & the Horizon,

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it is enough: But vpon the Lande, or looking out at a Windowe of an house, or standyng in the streete, you may adioyne vnto the one syde of your Transame a Plummert of Leade, thereby to finde out his perpendicularitie. Yet do I not thinke that so necessarie, because I know, that a litle practise wyl make the eye a reasonable iudge both of the perpendicularitie, and of the parallelitie.

Sc. Let vs now come vnto the particuler vse of the Staffe. You say that in seekyng out the elevation of the Sunne, I may choose whether I wyl set the Staffe vnto myne eye (as I do the Bella Stella) or whether I wyl holde it in myne hand.

M. It is so.

Sc. I pray you therefore instruct me first concernyng the vse of that, when I must set it vnto myne eye.

M. This one thing is not to be neglected, that it must stande on the ball of your cheeke, for that place is most conuenient, because it doth not lightly peele, neyther is the syght thereby distorted: Yet if any man thinke it meeter to apply the Staffe to the corner of his eye next to the eare, I wyl not gaynesay him, because the sight is not to every man so ready in one place as it is in an other.

Sc. How must I in this case toyne, the Transame and the Yarde together.

M. Put the Yarde into his socket, so that the notch may stande iust vpon the 45. degree. Then put the Transame into his socket in lyke maner, that the notch may be vpon the 45. degree.

Sc. Is it not materiall, which wayes the degrees stande, eyther vpwart or downewarde, or on the syde?

M. Let this be your rule: Keepe the degrees of the Yarde vpwart, and let the degrees of the Transame be towarde you, so shall you be the lesse deceyued. Otherwyle to them that are cunnyng, it is neyther here nor there.

Sc. Is there any thyng to be obserued in the placyng

Hand, muste one use small B 3 and is myghty one of

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of the Plane, more then hath bene said before.

M. This is to be noted, that the edge of the Vane must be placed iust with the highest degree of the Transame.

Sc. Eche thing being fitted in this maner, howe shall I take the height of the Sunne?

M. First, you must knowe whether the Sunne bee more or lesse then 45 degrees about the Horizon.

Sc. How shall I know that quickly? for me thinketh that should be troublesome.

M. It is most easie. The Transame and the Vard being ioynd together, as you haue bene taught: turne the 90. degrees of the Vard toward your breast (it is no matter for setting it vnto your eye) and bring the Transame right against the Sunne, vntill the shadowe thereof fall euen with the side of the Vard. If the shadow of the Transame from the toppe of the Vane downewarde be longer then the Vard, it is a most certaine signe that the Sunne is vnder 45. degrees high. If it be shorter, the Sunne is more then 45. degrees high.

Sc. If the Sunne bee lesse then 45. degrees high, what must I do?

M. Set the Staffe close to your eye, keeping the Vard parrallele vnto the Horizon, as you haue bene taught before: then let the Transame sinke downe into his Socket, vntill the toppe of the Plane come euen with the Centre of the Sunne, the number of the degrees from the top of the Plane to the notch of the Socket will declare his elevation.

Sc. This thing is plaine inough. May not his elevation yet be found out any other way by the Transame, while the Sunne is vnder 45. degrees.

M. It may be founde out other wise in this maner: Put that ende of the Transame into his Socket, which conteineth the beginning of the degrees, let the first degree come euen with the notch, as the 45. degree did before, and make the Transame fast with the serue: then set the vard vnto your eye, and keeping it leuell, moue the Plane vp and downe, vntill the

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the vppermost edge thereof come euen with the Centre of the Sunne: the degree vpon which it lighteth is the Sunnes altitude.

Sc. Thus much concerning the Sunne whiles hee is vnder 45. degrees. What must I do to finde his altitude being aboue 45. degrees?

Ma. The Vard, Transame, and Vane being orderly placed, as it was taught before, set the Vard vnto your eye, and keeping it leuell, drawe the Transame to you warde, untill the Vane be euen with the Centre of the Sunne: the degree then of the Vard, vpon which the notch of the Socket lighteth, declareth vnto you the height of the Sunne.

Sc. Is there any more to be saide concerning the vse of the Staffe, when it is applied vnto the eye?

Ma. No: For I haue at large declared the same: so that now it remaineth to tell you, how the Staffe may be vsed, although it be not applied vnto the eye.

Sc. One thing let me first remaunde: May not I take the height of any starre in the same maner as I haue taken the height of the Sunne?

Ma. Yes, that you may: Neither is there any difference in the one from the other. You may also take the distaunces of any two starres thereby, so that they bee not further asunder then 90. degrees, following the selfe same precepts which you haue bene taught concerning the Sunnes altitude. For if the two starres be lesse then 45. degrees asunder, they wil be within the ende of the Transame, and the Vard. Then set the Vard agaynst the one starre, and drawe the Transame into his socket, vntill the edge of the Vane light vpon the other starre, and the degrees of the Transame will shew their distance. If the two starres propounded be more then 45. degrees asunder, it is certaine, that they will bee without the compasse of the Transame. Then drawe the Transame towarde your sight, vntill the ende of the Vard light vpon the one starre, and the edge of the Vane vpon the other starre, and the degrees of the

The vse of Dials

the yarde will shewe their distance, so that you may take the distance of any two starres that are 90. degrees asunder.

Sc. Nowe let vs returne vnto the former question: howe must the Translame and the yarde bee ioyned together, and how must the Plane bee placed, if I bee not disposed to set the stasse vnto mine eye?

Ma. The ioyning of them is after diuerse maners, according as the vse doth differ. First, you may find the sunnes elevation in the same maner, as you did before, although you do not applie the stasse vnto your eye, and therefore in this case the Translame and the Yarde must bee ioyned together, as they were before, and the Plane must also stand after the same maner.

Sc. How then shall I find the Sunnes elevation?

Ma. Set the palme of your hande close to the ende of the yarde where the 90. degree is placed, and then turne the Translame vpon the Sunne, and pull downe the Translame into the socket, vntill the shadow of the coppe of the Plane fall iust vpon the ende of the yarde close to your hande. Then the degree of the Translame next vnto the socket, is the Sunnes elevation.

Sc. I perceiue that in this case also I must holde the yarde verie leuell.

Ma. Yea, that you must: and so shall you bee sure of the Sunnes altitude.

Sc. May I finde the Sunnes elevation thus, if he be more then 45. degrees high?

Ma. Yea, such as you bin before. For this is all the difference, that your hande standeth now in stead of your eye. And I am of that minde, that if you take heede vnto the leuell of your yarde, you may take the Sunne as precisely this way, as you do with applying the stasse vnto your eye. Besides, this is one conuenientie, you shall not see all your sight, and hurt it as you do before. And you shall not see the sunne, and hurt it as you do before. And other things there be, you may see the Diall, and

the Crosse Staffe.

and how must I ioyn the Transame and the Yarde together?

Ma. There is yet another way to finde out the height of the Sunne without setting the staffe vnto your eye. For the performance of which conclusion, you must set the Yarde and the Transame together thus. Put the Transame into his socket so, that the beginning of the first degree may fall iust with the notch: then make it fast with the scrue: Put the Yarde also into his socket, in such sort that the 45. degree fall euen with his notch, and set the Plane at the other ende of the Yarde, as you were instructed before.

Sc. How must I vse it then?

Ma. You must here also haue that consideration which you had before of the Sunnes eleuation, whether he be more or lesse then 45. degrees, which is knowen by the rule giuen in the beginning.

Sc. If the Sunne be lesse then 45. degrees high, how must I holde the staffe?

Ma. Let the Transame hang downwarde, towarde your feete, and turne the Plane which is vpon the Yarde to the sunne, vntill the shadowe of the Yarde fall iust with the side of the Transame: the degree of the Transame, vpon which the shadowe of the Plane dooth fall, declareth the height of the Sunne.

Sc. Is it materiall which side of the shadowe I do chuse?

Ma. Yea, For that side of the shadowe must bee chosen, which is made by that part of the Plane which is next vnto the end of the yarde, as you may see in the figure.

Sc. I perceyue your meaning in this. But howe must I holde the staffe, if the sunne be more then 45. degrees high?

Ma. Then must the Transame lie leuell with the Horizon, which before did hang perpendicular, and the yarde must stand vpright towarde your Zenith. Then turne the yarde toward the Sunne so, that the shadowe thereof fall close to the side of the Transame, marke vpon what degree of the Transame the shadow of the vppermost side of the Plane falleth, sub-

C.

duct

The vse of

duct that out of the 90. degrees, and the remainder betwixt the Sunnes eleuation.

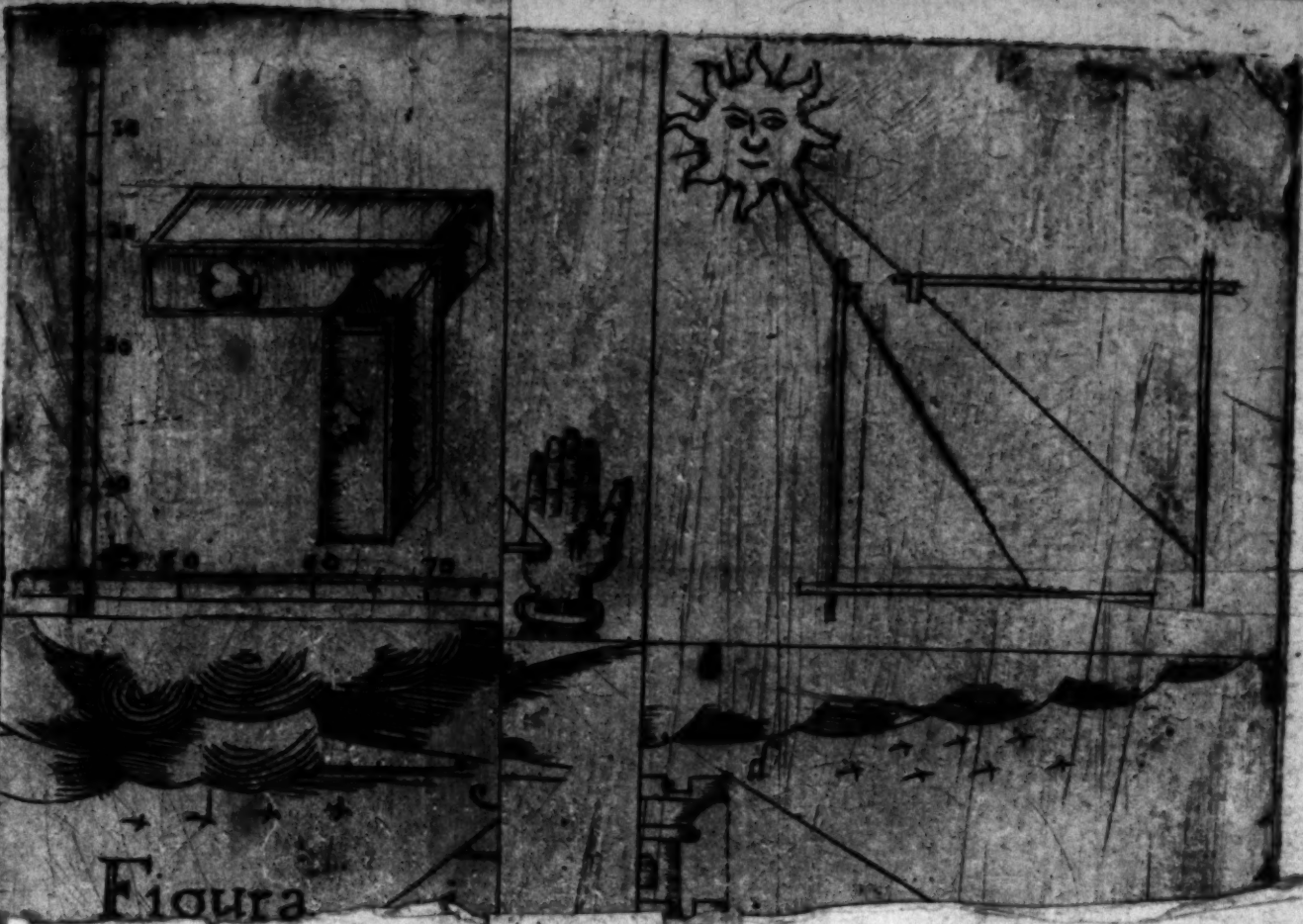
Sc. May not the height of the starres bee found out in this manner?

Ma. No: By reason their beame is so weake that it cannot cast a shadow: but the beame of the sunne being so strong, his height may thus be easily found out, and verie readily, and also certaily, hauing onely this care, that the staffe be kept leuell as it ought to be.

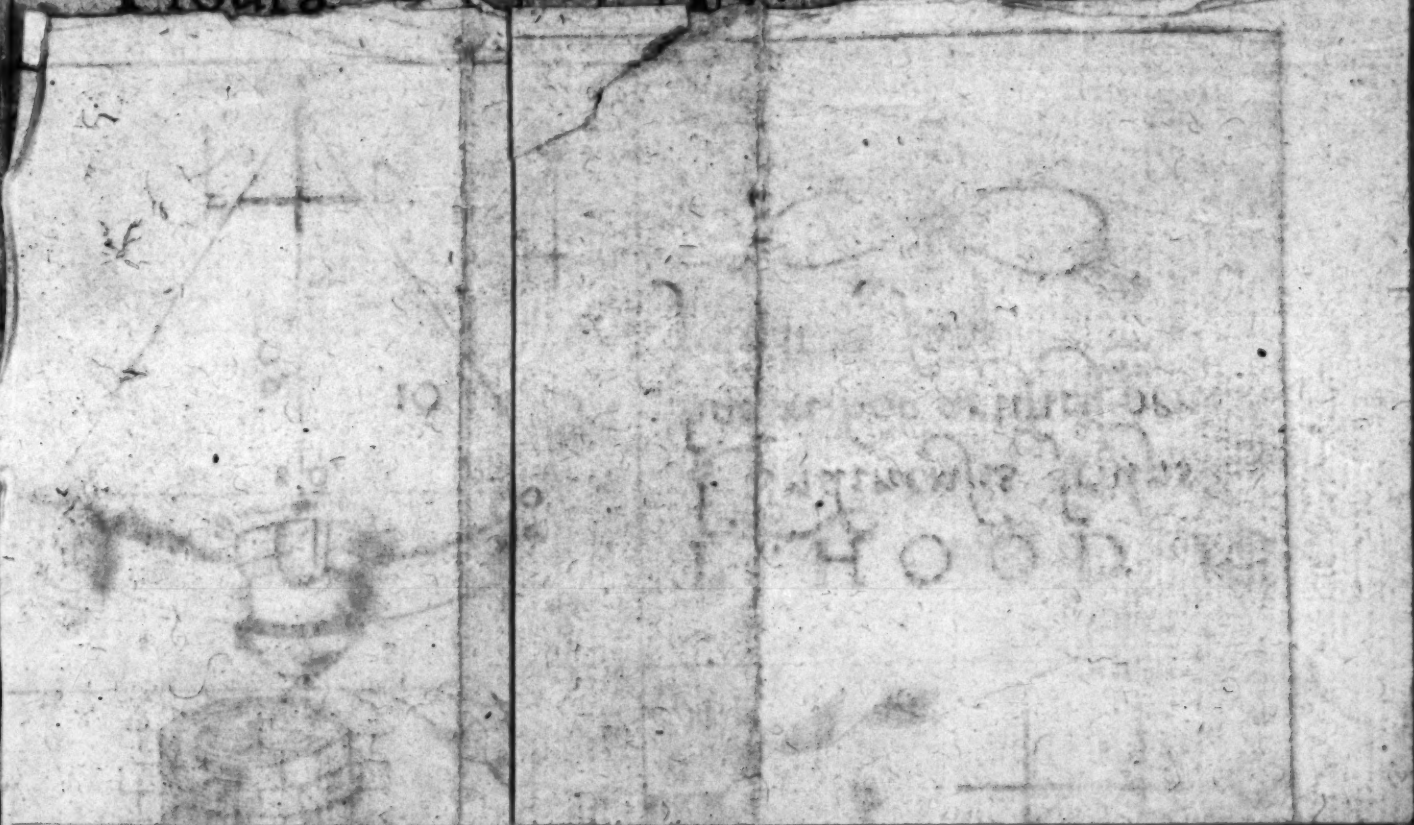
Sc. Is there any thing else to bee saide concerning the vse of this staffe?

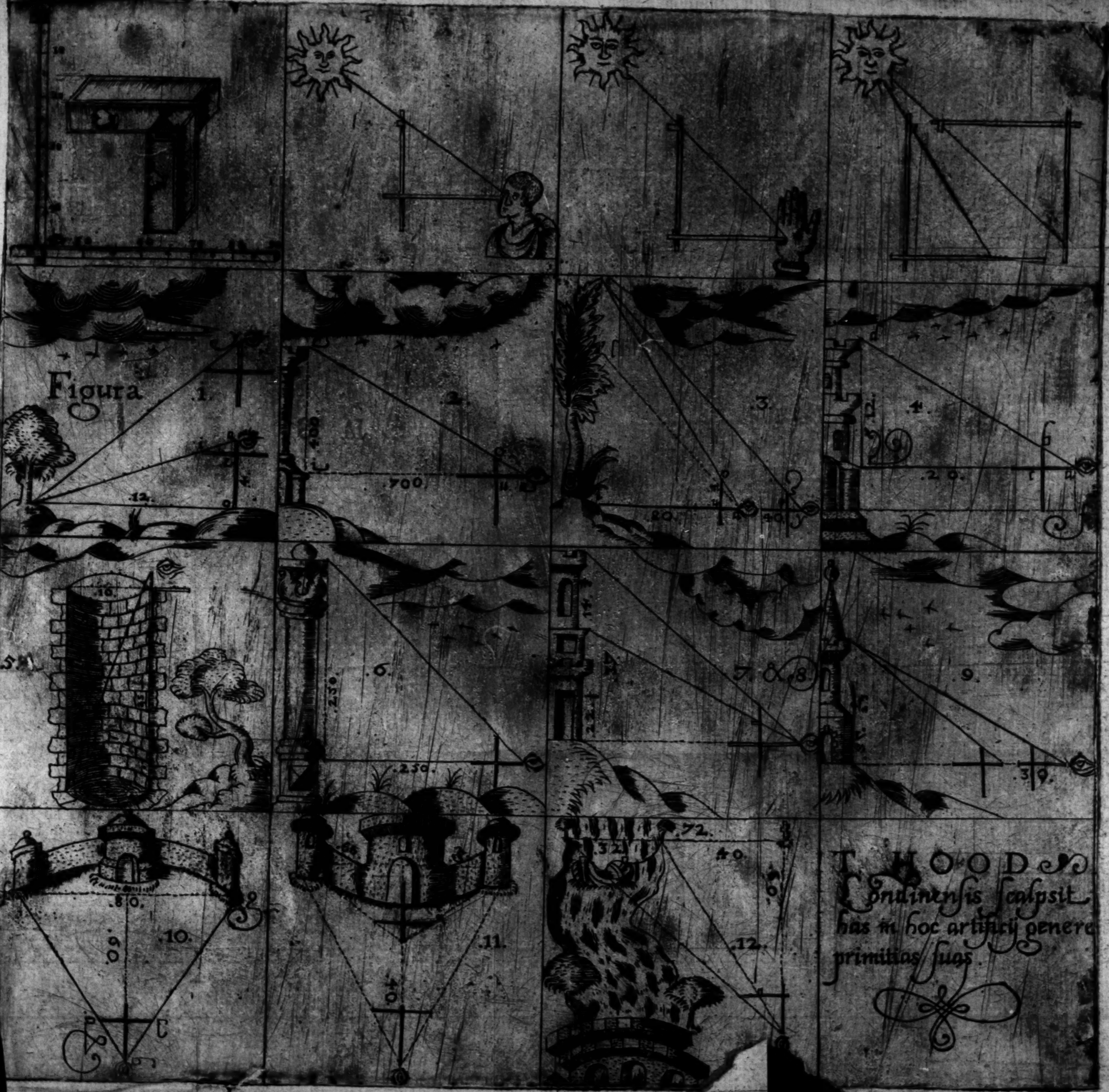
Ma. It may be vled to diuerse other purposes (as I saide in the beginning:) namely, to the description of Regions, and Countreys: to the finding out of the quantities of the Eclipses of the Sunne and Moone: with the longitude and latitude of the Planets. This staffe also serueth to the correcting of the places of the fixed starres: and to the setting downe of the amplitude of the rising or setting of the Sunne or Starres. But mine intent was onely to take the Sunnes eleuation there with. Yet haue I tolde you how to take the altitude of the Starres, with their distances, by the same staffe: which for this time shall suffice. The other propositions, I will lay forth, either in my publike lectures which I reade, or at other more convenient time, as my leysure serueth.

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FINIS



Figura





Figura

T. H. O. O. D.
 Conuincens scilicet
 has in hoc artificio genere
 primitias suas.